Message

**From:** Lindstrom, Andrew [Lindstrom.Andrew@epa.gov]
**Sent:** 8/7/2017 6:31:08 PM
**To:** Tony Fletcher [Tony.Fletcher@lshtm.ac.uk]
**CC:** Strynar, Mark [Strynar.Mark@epa.gov]; Newton, Seth [Newton.Seth@epa.gov]
**Subject:** RE: PFAS analytical collaboration on AFFFs
**Attachments:** NC DHHS Risk Assessment FAQ Final Clean 071417 PM.PDF

Tony,

Our EPA Regional Offices (Regions 3 and 5) have expressed considerable interest in the discovery of GenX in the Parkersburg area. We still haven't had a chance to fully brief them on our findings, but I'm hoping that they will start looking for GenX in any new sampling they do from here on.

The state of North Carolina has issued a drinking water goal for GenX of 140 ng/L. The attached document describes this new threshold.

Given that GenX has been detected in surface water in Holland, Germany, China, and now two separate locations in the US, I think folks will be much more interested in looking for this compound.

If you hear anything about GenX please let us know.

Thank you,

Andy

**From:** Tony Fletcher [mailto:Tony.Fletcher@lshtm.ac.uk]
**Sent:** Friday, August 04, 2017 8:35 AM
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>
**Cc:** Strynar, Mark <Strynar.Mark@epa.gov>; Newton, Seth <Newton.Seth@epa.gov>
**Subject:** RE: PFAS analytical collaboration on AFFFs

Andy

There was a MoU with Dupont getting private water wells tested. That may be expired, but if not maybe this extra testing could be mandated within that. Or you could suggest EPA does a pilot survey on water and serum in the affected area? I have suggest to the Keep your Promises people that they suggest some testing is done, but that would not be systematic, maybe just a few individuals enrolling in the medical screening or civil claims programs.

Tony

**From:** Lindstrom, Andrew [mailto:Lindstrom.Andrew@epa.gov]
**Sent:** 02 August 2017 20:31
**To:** Tony Fletcher <Tony.Fletcher@lshtm.ac.uk>
**Cc:** Strynar, Mark <Strynar.Mark@epa.gov>; Newton, Seth <Newton.Seth@epa.gov>
**Subject:** RE: PFAS analytical collaboration on AFFFs

Tony,

We tested a small number of finished drinking water samples and didn't find GenX using a lower limit of quantification of 10 ng/L. Maybe the current GAC systems are working for PFOA and GenX. If you have a GAC system that is. I suspect that we will find contaminated wells eventually.

That said, it's reasonable to assume that the soils are contaminated because surface water concentrations (lakes and streams) were above 100 ng/L in some locations. Other routes of exposure could be significant such as house dust, wild caught game, garden vegetables, maybe even airborne particulates.

GenX does not appear to break down in the environment or metabolically.

I recommend testing of blood and urine.

Thank you,

Andy

**From:** Tony Fletcher [mailto:Tony.Fletcher@lshtm.ac.uk]
**Sent:** Wednesday, August 02, 2017 3:14 PM
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>
**Cc:** Strynar, Mark <Strynar.Mark@epa.gov>; Newton, Seth <Newton.Seth@epa.gov>
**Subject:** Re: PFAS analytical collaboration on AFFFs

Thanks
I was wondering whether to suggest to contacts in Parkersburg that they should get recent blood samples checked for GenX near the dupont plant. A) do you know if that would make sense and B) as the water is GAC filtered for C8, would that mop up the GenX and C) do we know if the water has been tested for GenX near Parkersburg?

Tony

Tony Fletcher
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**From:** "Lindstrom, Andrew" <Lindstrom.Andrew@epa.gov>
**Date:** Wednesday, 2 August 2017 20:06
**To:** Tony Fletcher <Tony.Fletcher@lshtm.ac.uk>
**Cc:** "Strynar, Mark" <Strynar.Mark@epa.gov>, "Newton, Seth" <Newton.Seth@epa.gov>
**Subject:** RE: PFAS analytical collaboration on AFFFs

Tony,

Thank you for the update. I just sort of assumed everyone would be taking the summer off in Sweden and we'd eventually get back to it this fall.

We've been pretty much overwhelmed with the GenX issue we talked about at the Boston Conference. The State of North Carolina has established a drinking water goal of 140 ng/L and we've been very busy working with them to monitor the decline in GenX in local drinking water systems.

Please let us know when you are ready to resume discussions.

Thank you,

Andy

**From:** Tony Fletcher [mailto:Tony.Fletcher@lshtm.ac.uk]
**Sent:** Wednesday, August 02, 2017 12:14 PM
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>
**Subject:** RE: PFAS analytical collaboration on AFFFs

Hi Andy
I haven't forgotten this, with different people's holidays it is taking a bit of time to get all the details answered in Sweden.
More soon and I trust you get some good vacation.
Tony

**From:** Tony Fletcher
**Sent:** 30 June 2017 15:56
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>
**Cc:** Christian Lindh <christian.lindh@med.lu.se>; Kristina Jakobsson <kristina.jakobsson@amm.gu.se>; Strynar, Mark <Strynar.Mark@epa.gov>; Newton, Seth <Newton.Seth@epa.gov>
**Subject:** Re: PFAS analytical collaboration on AFFFs

Dear Andrew
Excellent that we can cooperate on this.
We will consult in the team, and come back with a full reply to all the points.
Tony

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**From:** "Lindstrom, Andrew" <Lindstrom.Andrew@epa.gov>
**Date:** Friday, 30 June 2017 14:52
**To:** Tony Fletcher <Tony.Fletcher@lshtm.ac.uk>
**Cc:** Christian Lindh <christian.lindh@med.lu.se>, Kristina Jakobsson <kristina.jakobsson@amm.gu.se>, "Strynar, Mark" <Strynar.Mark@epa.gov>, "Newton, Seth" <Newton.Seth@epa.gov>
**Subject:** RE: PFAS analytical collaboration on AFFFs

Tony,

I've spoken with Mark Strynar and Seth Newton about your proposal and they have indicated that they are interested in being involved with this interesting project.

I think your stepwise approach, starting with the more abundant most recent samples and progressing to the more valuable post exposure samples is a good idea. We'll need to fine tune our approach at bit, so a number of preliminary samples to experiment with would be good.

From our standpoint, we're looking for an opportunity to be among the first to describe the full range of PFAS that are present in human blood after AFFF exposure. I think this could be largely accomplished by an in depth analysis of a relatively small number of serum samples from individuals who had been conclusively exposed to AFFF-contaminated water – maybe as few as 10 - 30 individuals. We'd also want to contrast this with an appropriate number of controls.

I'm just kind of guessing at the numbers here and invite anyone to argue for more or fewer as they see fit. You may, for example, want to evaluate the differences between males and females or old and young, and that might require more samples for adequate power.

I'm suggesting a relatively small number of samples because with the nontargeted high resolution mass spectrometry approach that will be taken, we can pretty much see every individual PFAS that is present, all of their metabolites, and all of their individual isomers, so the amount of data that can be generated quickly becomes overwhelming. Previous evaluations of AFFF-contaminated groundwater suggest that there may be thousands of compounds present in these serum samples, and we know that we probably can't take the time to properly evaluate all of them. It's hard to say how this will turn out, but I'm guessing that we'd maybe look at the 100 largest peaks (compounds) or the 100 best matches to a database of AFFF-related compounds. Maybe it would be the top 300 peaks – it will depend on many different things (e.g., sample volume, instrument sensitivity, interferences, availability of standards), but the point is that we'll have to draw the line someplace.

You may also be thinking about a larger project, something where we'd run a larger subset of all the samples you have in order to evaluate potential associations with disease. This is a bit different than the first paper I've described above, but it is doable. From the paper you sent it looks like the Ronneby half-life cohort is 106 individuals while there were apparently 3418 people initially enrolled in the entire registry. Depending on how many serum samples you have available, it's possible that we could do a high resolution evaluation of a much larger number of samples (n = 300?) to meet the objective of evaluating the relationships with health conditions.

In any case, once we agree more specifically on a project focus we'll have to get a human studies exemption through our human studies review official before we can have samples shipped here. This review is basically an outline of the project we intend to conduct with the appropriate assurances and documentation that any human samples received on our end will be anonymized to the point where we cannot link any measurements to any specific individual.

Before I go much further I'd like to give you the chance to comment on what I've written above.

So right now I guess we need to know how the upper estimate of the number of samples (exposures and control) that you could be providing and what specifically you would like to investigate. If you could send copies of any human studies protocols and finding that pertain to this cohort that would also be helpful – even if they are only in Swedish.

One final thought is that it might be good to get a few of water and soil samples first as these do not require human studies clearance and they might allow us to establish the range of exposure compounds that we would expect to see in serum.

We look forward to working with you and your colleagues and hope that this will lead to some very interesting and helpful research.

Please let us know what you think.

Thank you very much,

Andy

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**From:** Tony Fletcher [mailto:Tony.Fletcher@lshtm.ac.uk]
**Sent:** Thursday, June 22, 2017 10:19 AM
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>
**Cc:** Christian Lindh <christian.lindh@med.lu.se>; Kristina Jakobsson <kristina.jakobsson@amm.gu.se>
**Subject:** Re: PFAS analytical collaboration on AFFFs

With attachment

Dear Andrew

It was good to catch up in Boston.

As you know we have been working on a population exposed to AFFF in Sweden via contaminated drinking water, affected by run-off from a military airport.

Initial analyses have identified very high serum levels of PFOS and PFHxS, and moderately raised PFOA. A brief description is given in the attached Technical report (though focused on half-life, it sumarises the average levels). We have not been able to obtain formulations of the various AFFFs which were used, but water measurements in the contaminated wells have so far identified some other raised PFAS: PFPeA, PFHxA, PFHpA, PFBS, PFHpS. We are concerned that there are other contaminants too. PFHpA and PFBS but not the others have been found elevated in some serum samples.

The method used hybrid triple quadrupole linear ion trap mass spectrometry equipped with a Turbolon Spray source (QTRAP 5500, Applied Biosystems). [Lindh CH, Rylander L, Toft G, Axmon A, Rignell-Hydbom A, Giwercman A, et al. Blood serum concentrations of perfluorinated compounds in men from Greenlandic Inuit and European populations. Chemosphere. 2012;88(11):1269-75]

Your work with Dr Strynar using high precision methods has been able to detect a wider array of PFAS and we would like to propose a collaboration on this exposure scenario. This population is unique in having a well established significant exposure to AFFF mixtures, but which needs to be better characterized. Exposure was promptly stopped on discovery of the exposure, but serum samples taken shortly afterwards have been archived and could be shared. We would like to offer some samples to be reanalyzed in your lab to establish the full spectrum of PFAS exposure. Ideally that would be a set of serum samples from the contaminated population, some control serum samples from an unexposed population, and samples of water from the contaminated drinking water supply and samples of contaminated land near the AFFF source. Aliquots from the same sample would be analysed in the Swedish lab in parallel. We suggest a first exploratory step using more recent samples from the exposed and control population; here we have no scarcity of stored serum. In a second step, serum from samplings closer to the end of exposure (some 6 weeks, some 6 months following clean-up) can be used for focused analyzes. For the latter group we have only limited aliquots in the biobank.

Please let us know if this would be acceptable in principle, and we can discuss practical questions of volumes and quantities of samples and shipping conditions.

With kind regards

Tony Fletcher, Kristina Jakobsson, Christian Lindh

**Tony Fletcher**

Associate Professor in Environmental Epidemiology (part time), Department of Social and Environmental Health Research, London School of Hygiene & Tropical Medicine.
&
Adjunct Research Professor in Environmental Health, Boston University School of Public Health, Boston, Mass.

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